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Abstract
New models of multi-period insurance show that health insurance buyers can be protected against changes in premiums from health shocks associated with chronic conditions by the addition of "guaranteed renewability" provisions. These models assume that a buyer's risk level in every time period is observed by all insurers. They also require a premium sequence that is "front-loaded," which may be costly to buyers if capital markets are imperfect. We relax the common knowledge feature of the model by assuming that a person's risk in any time period is known only by that individual and the current insurer. One might suspect that a premium sequence with higher later period premiums would be incentive compatible because low risks will have less desirable offerings from alternative insurers. However, we show that generally, only the original premium schedule is incentive compatible, and attempts to alter front-loading will not be an equilibrium.

Keywords
health insurance, adverse selection, guaranteed renewability, equilibrium

Disciplines
Business | Economics | Public Affairs, Public Policy and Public Administration

Guaranteed Renewability Uniquely Prevents Adverse Selection in Individual Health Insurance

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Abstract.

New models of multiperiod insurance show that it is possible for health insurance buyers in competitive insurance markets to be protected against changes in future premiums from health shocks associated with chronic conditions by the addition of “guaranteed renewability” provisions. These models have assumed that a buyer’s risk level in every time period is observed by all insurers, and they do require a premium sequence that is “front-loaded” in the early period, which may be costly to buyers if capital markets are imperfect. In this paper we relax the common knowledge assumption by assuming that a person’s risk in any time period is known only by that person and the current insurer. It is plausible in this model that a premium sequence with higher later period premiums may be incentive compatible because low risks will have less desirable offerings from alternative insurers. However, we show that under general circumstances only the original premium schedule is incentive compatible, and attempts to alter front-loading will not be an equilibrium. We comment on alternative ways to deal with front loading.

Introduction.

Insurance with a longer time perspective can improve efficiency by avoiding the problem of reclassification risk, the risk to the policyholder of a long period of above average future premiums for someone who unexpectedly becomes a high risk. Existing models of this process (Pauly, Kunreuther, and Hirth 1995; Cochrane 1995) assume that a buyer's risk level in each period is common knowledge, known to the buyer, the buyer's insurer in the current period, and all other insurers. In the initial period all buyers are known to be of equal risk; risks change in future periods as chronic illness strikes and persists, and all insurers know who has become higher or lower risk. Such "optimal guaranteed renewability" (OGR) models describe insurance that provides protection against the risk of future reclassification by insurers when they learn who has become higher risk. OGR contracts specify a unique time path for premiums as a function of the insured's age that minimizes the premium paid in each time period consistent with the incentive compatibility needed to keep policyholders at all risk levels continuing to participate in the contract. This is the policy that is optimal from a multi-period welfare economics perspective and sustainable in a world of free entry by competitive insurers.

In this paper, we modify the assumption about information to embody adverse selection with information asymmetry between insurance buyers and potential sellers in periods after the first period. For explicit reclassification risk to be an issue, at least some insurer must be able to tell that someone has become a high risk in order to reclassify that person; we plausibly assume that the initial insurer, who is in a position to observe claims and medical data, obtains this information. But we then assume that this information is not made common knowledge for other insurers. (There is another possible model in which only the insured person, and not even the current insurer, knows when and if the risk changes, but in which insurance is sold as a multi-period contract. We do not develop that model here.) We then ask if this change in the information structure, limiting the information available to other insurers, makes a difference. What kind of multi-period insurance policies might be sustainable when adverse selection is thus present, and how might they compare, in terms of efficiency or equilibrium, to the optimal "guaranteed renewable" policy in the common knowledge model?

One might anticipate a difference. The OGR policy "frontloads" additional premiums in the early years of a policy to collect funds that are then used to just offset the later difference between the low risk premium and the expected expense of those who have become higher risks that persists until the person goes on Medicare. Ignoring loading, the OGR premium sequence in every period exactly equals the expected cost of a low risk insured from that period forward. With literally perfect capital markets, OGR would not be superior to payment of a lifetime premium, but some transactions costs of borrowing or financing a very large lifetime lump sum would make the periodic payment possible in OGR superior. If capital markets are even more imperfect, so that there would be significant costs even to funding these payments, such frontloading may be undesirable (Frick 1998). But the OGR frontloading is unavoidable in the full information model with a single level of coverage sold at uniform premiums in each time period. If not enough is collected in the earlier periods to fully fund those who become high risks, an insurer that tries to collect it later from those who remained low risks would cause those low risks to defect to other insurers. If those who remain low risks are not charged more than the OGR premium for the specified coverage in some future period, the insurer would be unable to cover the cost of its commitment to the remaining high risks. An important question then is whether, in a model where outside insurers cannot identify low risks directly, but does know the details of the offerings by the inside insurer, more of the premium for high risks could feasibly be collected later in the period, thus reducing the early capital burden relative to the benchmark OGR policy. The relaxation of the possibility that low risks will defect to outside insurers, caused by the inability of those insurers to identify specific individuals as low risks, might lead to a lower feasible premium in the very early years of the GR contract and thus provide some benefit to offset capital market imperfections. This paper will not model the general problem of insurance purchasing under imperfect consumer capital markets, but will use that imperfection as a motivation for insurers to consider alternatives to OGR. (For further extensions of the “guaranteed renewability” (GR) model, see Pauly (2006).)

We first show that, not surprisingly, the benchmark OGR policy that is incentive compatible in a model with common knowledge is also immune to adverse selection in the asymmetric information model. But is there a less demanding policy still offering protection against reclassification risk that can also survive in the adverse selection scenario? We next show that, surprisingly, that no such improvement is possible: only the OGR policy is a feasible policy, even with asymmetric information, as long as potential insurers offering a single level of coverage at a single premium make the traditional assumptions of the Rothschild-Stiglitz (RS) model. That is, the OGR premium schedule is surprisingly robust, and would prevail in competitive insurance markets regardless of what insurers know about differences across individuals in risk levels. We then consider informally some modifications of this story in order to see what needs to be assumed to reduce the frontloading “burden” in GR markets. We find that either outside insurers must behave differently or protection against reclassification risk must be sacrificed.

Assumptions.

We will adopt the set of assumptions used by Rothschild and Stiglitz in their classic treatment of adverse selection (1976). There are two levels of risk: high risks with loss probabilities p_H for a loss of $\$X$, and low risks with a probability of p_L. Individual consumers know their own risk level. Insurers newly enrolling a consumer know the proportion of high and low risks in a population of potential insureds at any point in time and/or at any age, but they cannot distinguish between high risks and low risks. Competitive insurers offer a variety of policies for sale; policies differ in terms of the number of insured dollars I they will pay if a loss occurs $(X \geq I > 0)$. All insurers know the total amount of coverage an individual has obtained. All policies consist of a prespecified level of coverage that will be sold at a uniform premium to all buyers.

We invoke the assumptions of the simple three-period model we used in our treatment of guaranteed renewability. A population begins in period 1 with all potential consumers as low risks facing the uniform loss probability p_L. The proportion of buyers who actually suffer a loss of $\$X$ in period 1 become high risks in periods 2 and 3, while the proportion of remaining low risks who suffer a loss in period 2 become high risks for period 3 only.

A time path of premiums Π and policies I is a competitive equilibrium if no insurer can enter with a new policy and attract a set of buyers who allow it to have a positive expected profit.

We have previously shown that there is an optimal GR contract for a given amount of insurance purchased I^*. The quantity I^* is the expected utility maximizing amount of coverage purchased by a low risk facing a premium for that policy that reflected only the loss probability p_L. If the only thing that changes from period to period is the risk level, the optimal quantity will remain at I^* as long as income effects from changes in the magnitude of current-period premiums are absent[1]. For simplicity, we assume the administrative cost loading is zero, so the low risk premium Π_L equals p_L and the amount of insurance I equals X, the cost of treatment. As noted, we also assume that a high risk facing a fair premium p_H would also demand $I = X = I^*$.

We assumed in our earlier article that all insurers knew each person's value of p at every point in time. In this modification, we continue to assume that the insurer that sold insurance to a consumer in one period knows perfectly that person's risk in subsequent periods. After all, risk reclassification is only an issue if the initial insurer can know any change in risk level and therefore base premiums on the new level. That is, the initial insurer commits to avoiding reunderwriting, selective premium increases, or encouraging self selection by offering different coverage levels. However, other insurers that might attract the consumer away from the initial insurer and contract now are assumed to be ignorant of changes in each person's risk level and not constrained in what they might offer. Outside insurers know the proportion who have become high risk in each future period, but not which persons experienced such changes.

[1] Ehrlich and Becker (1972) show that, for a given level of risk aversion and a loading percentage that is independent of the probability of loss, the amount of insurance purchased will not depend on the loss probability.

OGR is adverse-selection proof.

It is easy to see that the policy with $I = I^* = X$ and the OGR premium schedule is not vulnerable to adverse selection. That is, in a market where all buyers offer this policy in every time period, no insurer can enter and offer a policy with different values of I other than I^* and a set of premiums that would allow it to earn profits. While this point is fairly obvious, we present the argument here as a template for further analysis in this paper. Let us begin with the last period, before the person exits the market (for Medicare). The OGR premium in this period is the low risk premium (for that age cohort); it is clear that no outside insurer that might expect to attract at least some people who have become high risks could profitably offer a lower premium for the I^* policy or for any other policy since I^* is the optimal policy and the low risk premium is the lowest feasible price. To be more specific: any outside insurer will either offer a policy that will attract both high and low risks, or a policy that attracts only low risks. To break even while attracting all risks, the premium will have to be the community rated or average premium, which is higher than the OGR low risk premium. To attract only low risks, an insurer will have to offer a policy with lower coverage than I^*, coverage so low that higher risks will not prefer it to I^*. But then all buyers will prefer the policy offering I^* to that policy, since the I^* policy maximizes expected utility at the low risk premium.

What about the second-last period? In this case the OGR premium is the low risk premium for that period plus the difference between the last period low risk premium and the high risk premium for those who become high risks in the second last period, again for the I^* policy.

Since the OGR policy is optimal for those who are low risk in the second last period, there is no policy-premium combination an outside insurer could feasibly offer that would attract them. Here again, an insurer expecting to attract all risks will have to charge more than the OGR policy, while an insurer attracting only the low risks in the second-last period will have to offer suboptimal coverage (and somehow protect against risk reclassification for the next period). By backwards induction using the same argument, OGR is preferred to any outside premium in any earlier period. More generally, the plan to lower premiums relative to OGR in early periods and offset by raising them in some future period will not work.

Imperfect information and any GR contract.

But might there be some premium schedule other than the GR schedule that could be sustained in a world of asymmetric information? If the answer is yes, and if this alternative has lower capital market costs than the benchmark policy, we might expect such an alternative policy to be chosen if capital markets are less than perfect. However, we conclude that no such policy, offering a single premium and a single level of coverage, could displace OGR.

We first give the technical explanation, and then illustrate it diagrammatically. In this model, a policy which charged more than p_L in the last period would not automatically lose the low risks, because outside insurers cannot identify them directly. However, if the policy did offer I^* at a premium above p_L, and is intended to be sold to all risks (as OGR is), that cannot be an equilibrium. We know there exists some other single period policy with $I < I^*$ and $p = p_L + d$ that would attract only the low risks; the high risks would prefer to remain with the old coverage at the old premium. Hence the hypothesized "shallower" premium schedule could not profitably be maintained. That is, any premium that tried to move away from the OGR benchmark low risk premium and toward a pooled premium for the I^* policy could be undercut by an outside insurer offering less generous coverage than I^* that would attract the lower risks. This is because the quantity I^* is larger than the amount low risks would ideally want to purchase if they could purchase varying amounts of coverage at the higher premium $p_L + d$; the lower risks are not in equilibrium at the quantity I^* at any premium other than the low risk premium. The only way for them to be in equilibrium at I^* is for the premium to remain at p_L.

What about the second-last period in this new model? The same argument applies. The premium here needs to be high enough (ignoring interest) to collect sufficient funds to cover the costs in excess of p_L for the people who became high risks in period 2 and will be retaining coverage in period 3. Would there be a higher premium for the I^* policy that the original insurer could collect? The answer is negative because any such higher premium would trigger on offer by an outside insurer with a lower level of coverage and a low risk two-period premium that would attract the low risks and not the high risks. The expected utility for a low risk is the utility from having full coverage in both periods 2 and 3 and paying an actuarially fair cumulative premium over both periods. A prospective low risk customer in period 2 might prefer to pay the single-period low risk premium in period 2 and then pay the low risk premium in period 3, whether a high or low risk by that time, but access to the GR premium in period 3 is limited to those who paid extra for it in period 2, so this choice is not feasible.

Understanding the problem.

This conclusion is counterintuitive. Shouldn't making the information available to outside insurers less complete cause there to be a higher price the inside insurer could charge in the later years that would be sustainable, since the outside insurers would only be able to pick off low risks if they offered them something better than their option in the initial insurance? Especially now that the ability of outside insurers to identify who could be offered something better has been reduced? The answer is negative, but why?

Fig. 1 illustrates.

Let us consider the last period, in which the OGR policy would face everyone with the low risk premium. Is there a way to charge more than that amount (in order to offset earlier lower-than-OGR charges) and still keep the low risks in the OGR policy so that the insurer can cover its costs? The line p_L shows the actuarially fair budget line facing a low risk, while p_H shows the line facing an otherwise-similar high risk. Both are assumed to have the same optimal OGR insurance level I^* (which under the assumptions of actuarial fairness and no moral hazard will be full coverage). Under OGR, both high and low risks face the low risk premium p_L in period 2, so point E^* would represent the equilibrium (with associated indifference curves) that buyers would achieve under OGR.

We could represent a reduction in early-period front-loading and a shift in cost to the last period as a shift of the final-period GR budget line downwards and to the left from p_L for the people in the GR policy. The limiting case of this shift is a budget line that would represent a weighted average of the two risk levels; if premiums were set along this budget line and everyone still purchased, the insurer would collect enough in period 2 to cover its benefits costs in period 2, so there would be zero period 1 frontloading; this is shown in Figure 1 as p_B (for "both").

This policy is very similar to the Rothschild-Stiglitz single period pooled policy (which in their model is not an equilibrium). It is the budget line a new insurer would expect if it offered coverage without knowledge of buyer risk levels but expected to attract both types of buyers. It would expect to break even at any point along p_B. The key determinant of the quantity of coverage such an insurer could offer and still attract both risk levels is the amount of coverage a low risk would prefer along that budget line; high risks would always prefer more generous coverage at the same premium rates. That potential pooling equilibrium quantity is at the tangency at B^*, with associated indifference curves I_H^* and I_L^*. However, in the Rothschild-Stiglitz model this pooling equilibrium is not stable since an outside insurer could offer another policy with less coverage that low risks would prefer to the pooled policy but high risks would not; policies along the low risk line from S to T would satisfy this condition. Thus the best outcome for a low risk that could be offered by an outside insurer is the policy at T. This policy maximizes the low risk person's utility conditional on high risks remaining out of the pool and the outside insurer breaking even.

It therefore follows that a GR plan that shifted the budget line downwards might still be selection-proof as long as it kept low risks on a higher indifference curve than the one through T; such a plan would make low risks as well off as they would be if they selected the separating policy. The policy with the lowest front loading that meets these constraints is the policy at R in the diagram. This policy still has full coverage (I^*) even though, at the implied unit premium through R, low risks would prefer less coverage--because movement away from R would increase low risk utility by less than it reduced high risk utility—so R maximizes expected utility.

However, even this policy would not be able to be sustained, because there is another policy along the fair odds line for low risks that is better than R for low risks but not for high risks. The two indifference curves through R, I_H' and I_L', allow for a policy on the fair odds line for low risks that low risks will prefer to the “overpriced” GR policy at R but the high risks will not. Hence the pooled policy will not be an equilibrium.

This argument will be true for any extent of “overcharging” relative to the OGR premium, in any “late” period. *So even with adverse selection, only the OGR premia describe a stable multi-period equilibrium.*

The fundamental problem is that any policy with a premium in any time period which moves away from the OGR schedule is, in effect, a pooled policy (or at least a partially pooled policy) in the Rothschild-Stiglitz sense, and we know that no pooled policy can represent a competitive equilibrium. In effect, the ability of outside insurers to attract away low risks does not depend on the utility level of low risks in the original plan but on whether they can get the low risks to self select. This happens in the breakeven Rothschild-Stiglitz policy, but it also happens in any plan where the premium is above the low risk premium. The reason is that some point on the low risk fair odds line is always available to outside insurers as long as they can get low risks to self select. But since high risks prefer more coverage on the low risk fair odds line to a policy with less coverage but on the same line that is at least as good for low risks as the inside policy, the inside policy can be self selected against, and so cannot be an equilibrium. And if there is no equilibrium in which the low risks remain in the plan, there is no way for the insurer to collect more (than OGR) in later periods to offset charging less (than OGR) in the early periods.

Of course, selection of this type by outside insurers requires that they know the quantity of insurance and premium being charged by the original insurer. They need this information to determine what alternative policy with lower premium and lower coverage will attract only the low risks.

To sum up: the OGR contract makes transfers to high risks that are collected *before* individual health statuses are revealed, and so prevents adverse selection; it makes transfers across periods as well as within periods. Therefore in the OGR contract the low and high risk can remain together in a “pseudo-pooled” contract. If the insurer were to attempt to lower the front-loading of the premium, it would effectively be trying to implement the pooled-within-period-only Rothschild-Stiglitz policy, and that would create incentives for those who remained low risk and outside insurers to agree on a policy that attracts only low risks.

To sum up: the OGR contract makes transfers to high risks that are collected *before* individual health statuses are revealed, and so prevents adverse selection; it makes transfers across periods as well as within periods. Therefore in the OGR contract the low and high risk can remain

together in a “pseudo-pooled” contract. If the insurer were to attempt to lower the front-loading of the premium, it would effectively be trying to implement the pooled-within-period-only Rothschild-Stiglitz policy, and that would create incentives for those who remained low risk and outside insurers to agree on a policy that attracts only low risks.

Alternatives assumptions and alternative models.

This somewhat surprising result obviously depends on modeling decisionmaking about insurance as the step-by-step myopic process envisioned by the Rothschild-Stiglitz model. Given the conceptual advantages to reducing frontloading when we move from full information to adverse selection, isn’t there a way for the GR insurer to compress this process so as to make a less demanding but preferred policy feasible?

There are two ways to think about alternatives. One way is to retain the single-premium, single coverage model but modify the story about competitive strategy. The other is to imagine that, at least in some future periods, the insurer might propose different policies or different premiums.

Consider the first approach. In the diagram as drawn, the policy offered to low risks that picks them off from the overcharged GR policy is itself not sustainable in the long run, since exit of low risks mean that the pooled policy will no longer survive, and the high risks will then move into the “pickoff” policy; in the diagram, there is no equilibrium. Perhaps insureds and insurers will have enough foresight to see this, and there are alternative concepts of insurer beliefs (Miyazaki 1977; Wilson 1977) that could be employed (though few of them allow a pooled policy to be an equilibrium). Potential insurer entrants would note that the pooled policy which retains the high risks will not be able to be offered once the low risks depart; as Wilson hypothesizes, this foresight would then discourage them from offering the policy that attracts the low risk in the previous round. That is, this policy that attracts the low risks does not remain profitable once the policy offered by the initial insurer becomes unprofitable and disappears. The fact that there are few “next periods” as people approach age 65 might also contribute to stability of the “overpriced” GR solution.

What about the second approach? The simplest alternative is to assume that the inside insurer does propose to charge a higher premium to those who become high risks, but offers a sufficient reduction in frontloading to make a modest exposure to reclassification risk acceptable. It therefore selectively raises premiums for high risks above that for low risks in those future periods when the high risk buyer can best “afford” (or most prefers) to pay more than the low risk premium. (One problem here is that only the inside insurer knows who is low risk, and so may be motivated to take advantage of them as well, along the lines suggested by Kunreuther and Pauly in their analysis of insurance market equilibrium with private knowledge (1985).)

This second outcome might also be what would ensue regardless of explicit insurer behavior if the premium in later periods is raised above the OGR level and low risks depart, leaving the insurer only with the high risks. To break even, the insurer would then have to charge the high risks more than the low risk premium that would have prevailed under OGR; this could have them paying exactly the same premium as would have prevailed under the explicit risk rating discussed in the preceding paragraph.

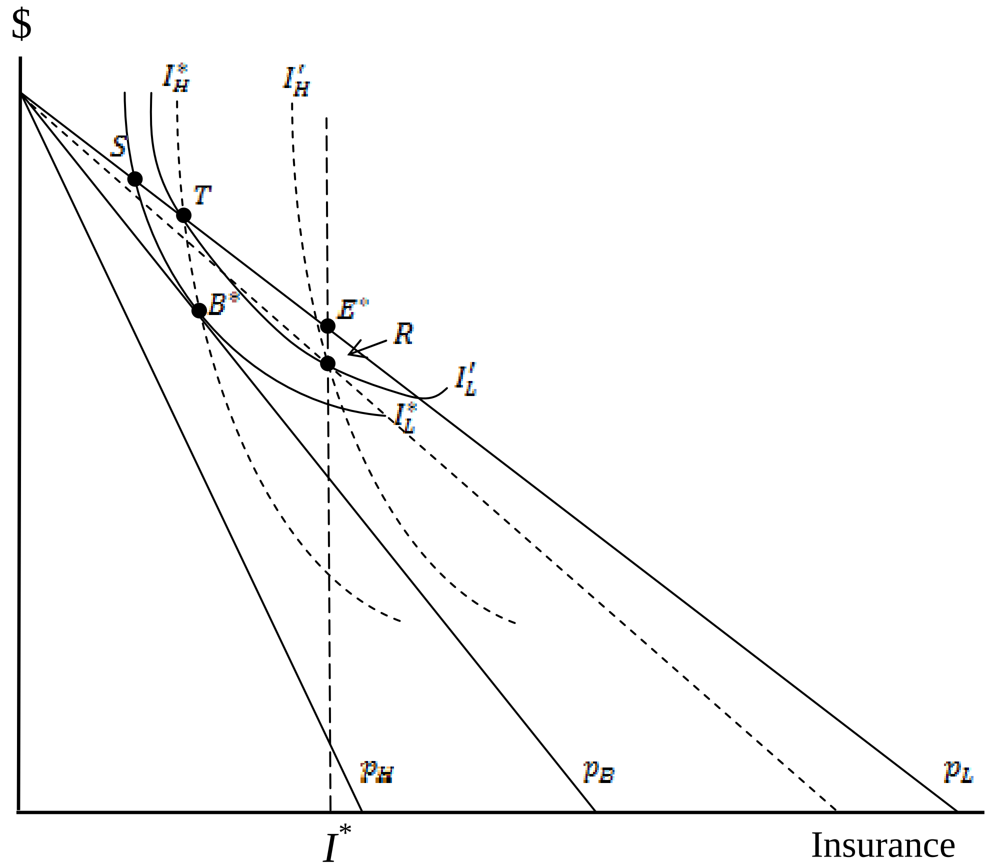
In the face of high capital costs to paying the early period frontloaded OGR premiums, buyers might prefer to accept a modest amount of reclassification risk as a second-best optimum. As discussed above this risk could either be made explicit or become the natural result of the breakdown of the insurance pool when premiums rise enough to drive out low risks.

Conclusion.

Introducing the possibility of adverse selection required introducing the possibility that the amount of coverage per contract could be varied, a contrast to the benchmark GR models. So long as we maintain the RS assumption that all insurers know the total amount of coverage a person has purchased, we have shown that the OGR scheme is also the only equilibrium scheme that protects against reclassification risk even when outside insurers cannot distinguish among risks. This conclusion will not hold if buyers can purchase coverage from more than one firm without other insurers being aware of this fact (Pauly and Kunreuther 1983). It will also not hold if the insurer that sold GR coverage is able to use the information it has acquired on each insured's risk to modify the contract quoted to that person on an individual basis, or if it can reduce service or in other ways lower the quality of the product for the high risks once those who have become higher risks are locked in. Finally, it will not hold if the potentially new insurer notes that the high risks will not remain with the OGR policy once the lower risks have been attracted away. But the first action would violate the explicit promise inherent in GR, the second should be able to be detected by prospective new purchasers who would punish such "skimping" firms by refusing to buy, and the third violates the single period expectational structure of the

Rothschild-Stiglitz model. Essentially, an attempt to rely on low risk individuals to pay more than their expected costs in later periods in order to relax the need to front-load premiums in early periods cannot be sustained in equilibrium, even if other insurer cannot identify low risks and even if, as is the case in the OGR policy, the pooling contract would not be withdrawn after the defection of low risks. So it seems that the optimal GR premium schedule has a strong claim to being the unique best solution to the problem of risk reclassification.

Figure 1



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